

# Behind & Beyond the Meter

**AEMC Symposium**

29 Aug 2019

Sydney, NSW

**Fereidoon Sioshansi**

**Menlo Energy Economics**

San Francisco CA

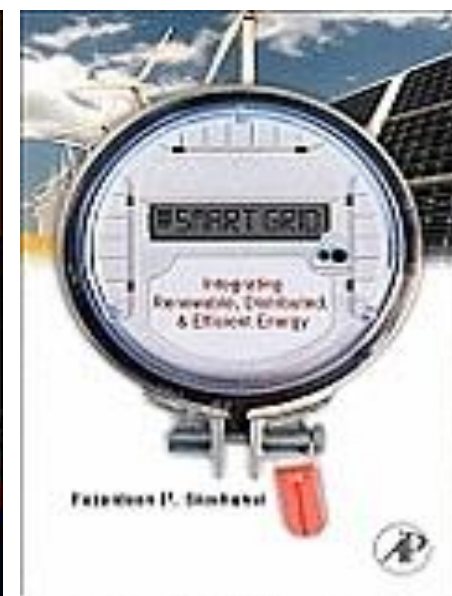
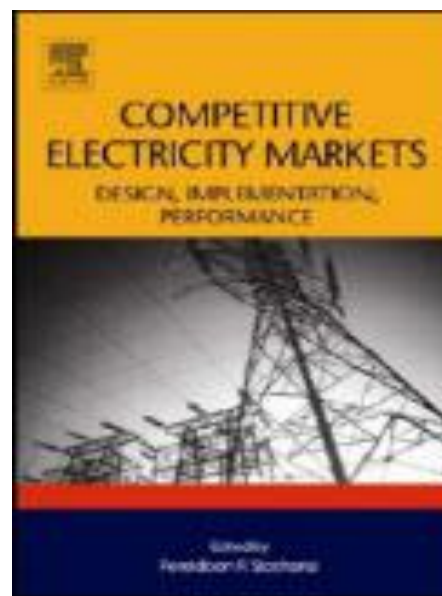
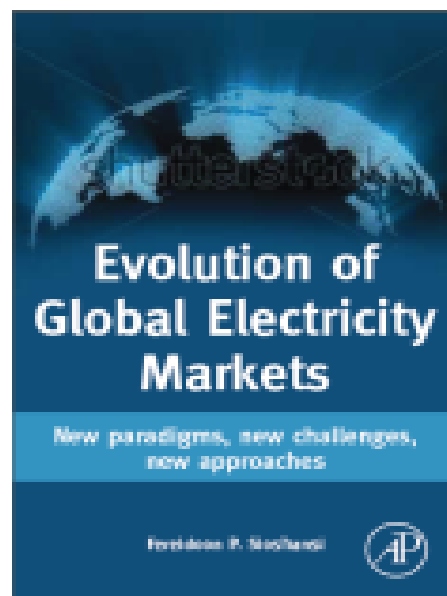
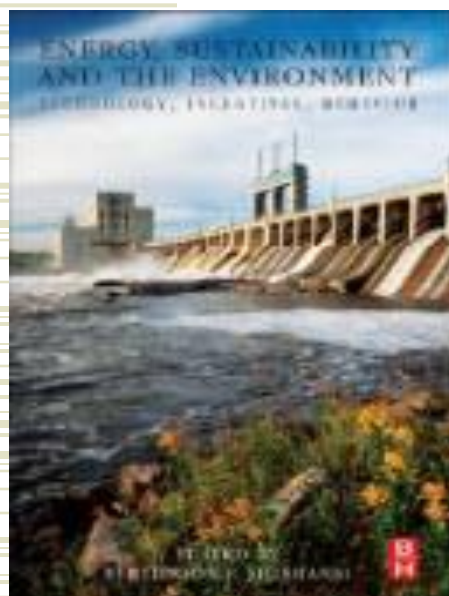
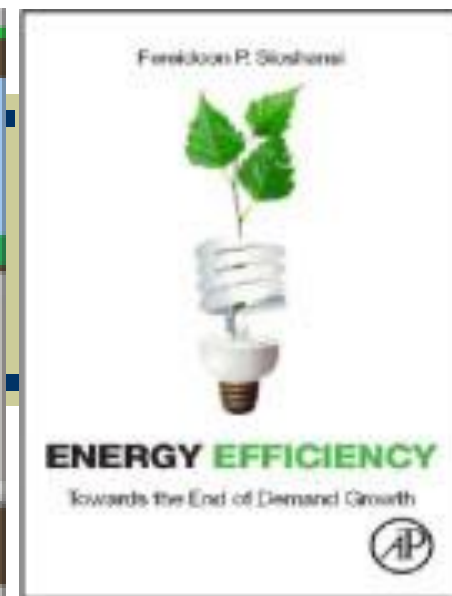
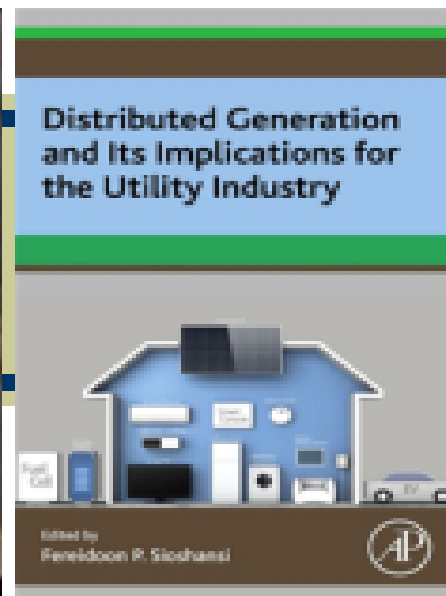
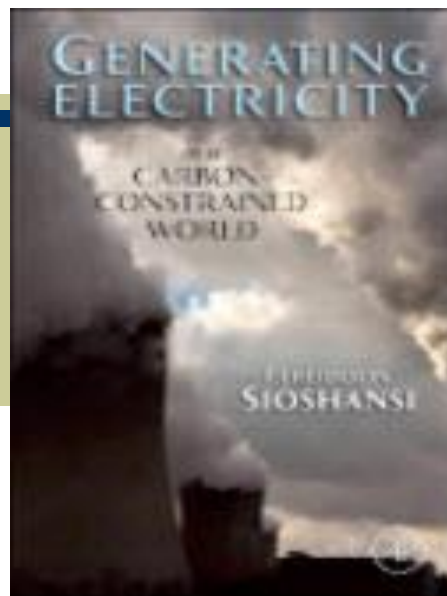
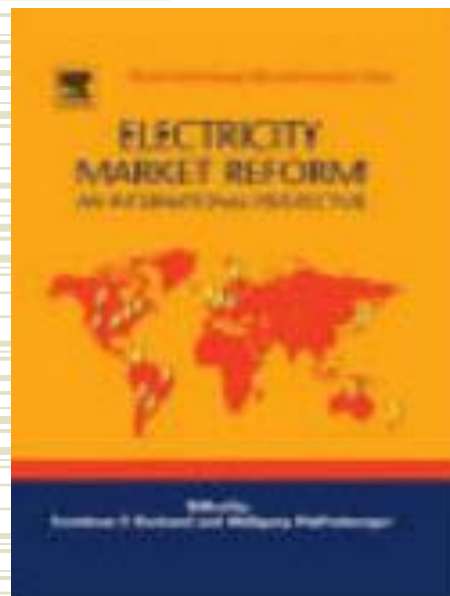
[www.menloenergy.com](http://www.menloenergy.com)

# Thank you

- ◆ To the organizers for making this possible
- ◆ To fellow speakers for contributing
- ◆ To attendees for participating
- ◆ Objectives
  - Share views, perspectives, experiences
  - Explore opportunities to collaborate
  - Discuss next steps

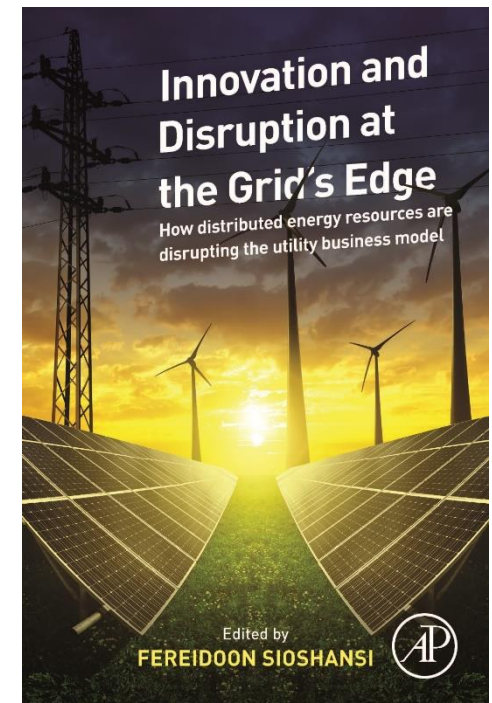
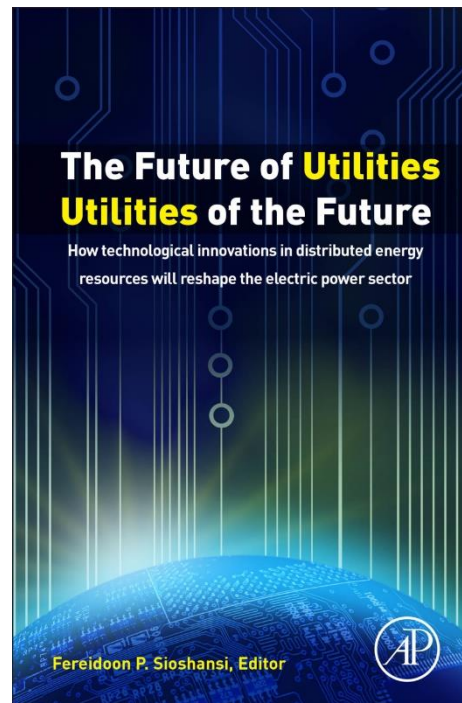
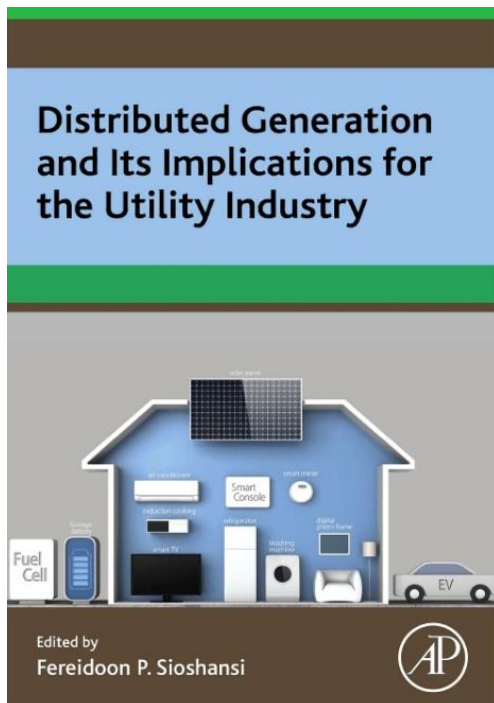
# Outline

- ◆ Background on BTM book
- ◆ Set the stage
- ◆ Objective
  - Encourage active participation/dialogue
  - Keep to schedule



# Last 3 volumes

relevant to today's discussions



# Consumer, Prosumer, Prosumager

How service innovations will  
disrupt the utility business model



Edited by  
Fereidoon Sioshansi





# BEHIND AND BEYOND THE METER

DIGITALIZATION, AGGREGATION,  
OPTIMIZATION, MONETIZATION



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# Symposia

- ◆ Four major ones focused on BTM
  - Florence, Italy 15 Feb
  - Silicon Valley, CA 26 Feb
  - Sydney, NSW 29 Aug
  - Schönaue, SW Germany 23 Sept
- ◆ Few others partially focused on BTM
  - Micro-grids, Crete 22-23 May
  - Micro-grids, Ft. Collins, CO 10-12 Aug
- ◆ Other collaborative exchanges
  - ◆ Oxford, MIT



# Questions

- ◆ What is behind-the-meter & why does it matter?
- ◆ How can individuals or communities be aggregated?
- ◆ Role of intelligent intermediaries or “orchestrators”
- ◆ What are key enabling technologies?
- ◆ How can value be created BTM?
- ◆ Transactive energy, P2P trading, VPPs
- ◆ Customer value, behavior & capacity to choose/decide
- ◆ Tariffs & BTM governance
- ◆ Network regulation & efficient BTM investment
- ◆ What’s in it for customers, for the network , for society

# What is BTM?

- ◆ Potentially all **energy** using devices
  - Lights, HVAC, washers/dryers, electronics, pumps, motors
  - Natural gas assets replaced by all-electric
- ◆ Distributed generation
  - Rooftop solar PVs, ground-source heat pumps, other
- ◆ EVs
  - Charging (G2V) &/or discharging (V2G)
- ◆ Distributed storage
  - Batteries, hot/cold water tanks, other storage media

# What is driving BTM?

- ◆ Mandates
- ◆ Markets
- ◆ Enabling technology
- ◆ Cost/economics
- ◆ Inefficient tariffs
- ◆ Disruptions
- ◆ Supportive/discouraging regulations

# No gas hookups in Berkeley

Starting 2020 no more gas hookups allowed



# You want a building permit?

Mayor of Lancaster, CA: 2 Watts per sq. ft.



Source: <https://www.eenews.net/stories/1059977514>

# How many Powerwalls?

CA leads the way



Source: PG&E Blackout Plan Energizes Rivals, The Wall Street Journal, 16 Jul 2019  
<https://www.wsj.com/articles/pg-e-braces-for-power-cuts-and-rival-providers-see-an-opening-11563193150>



# Window with IP address?

Does that count as BTM asset



# Rooftop power plants

Definitely BTM



# Dawn of perpetual motion machine?

- ◆ Technology increasingly allows self-generation, storage & consumption w minimal reliance on the network
- ◆ Next: P2P trading?





# Stand-alone light pole



# Stand-alone parking meter





# Generate & store where you use

Self-contained bus stop in Zaragoza, Spain



Source: Onyx Solar newsletter, Nov 2018

# Charge it from the sun

BTM?



# Free solar EV charger



# EV charging

No network?





# House boat



# Ben Schlesinger's ZNE home

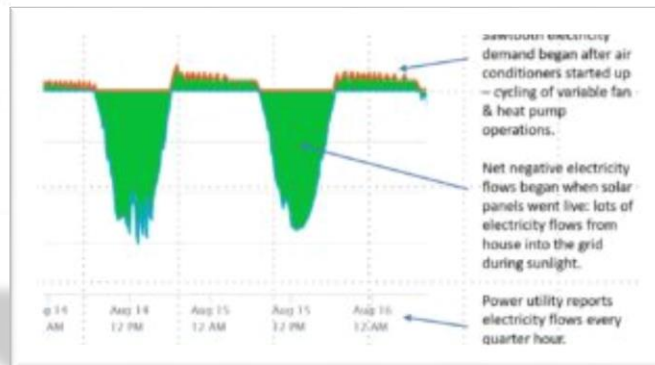
- ◆ Goal: Affordable low carbon lifestyle
  - Ground source heat pump
  - 18 kW of rooftop solar
  - 3 Tesla Powerwall batteries
  - 2 Tesla EVs
  - Plus thousands in HVAC, lighting, appliances
- ◆ Charge EVs from the sun
- ◆ More on website <http://bsaenergy.com/wordpress1/>





# What makes it ZNE?



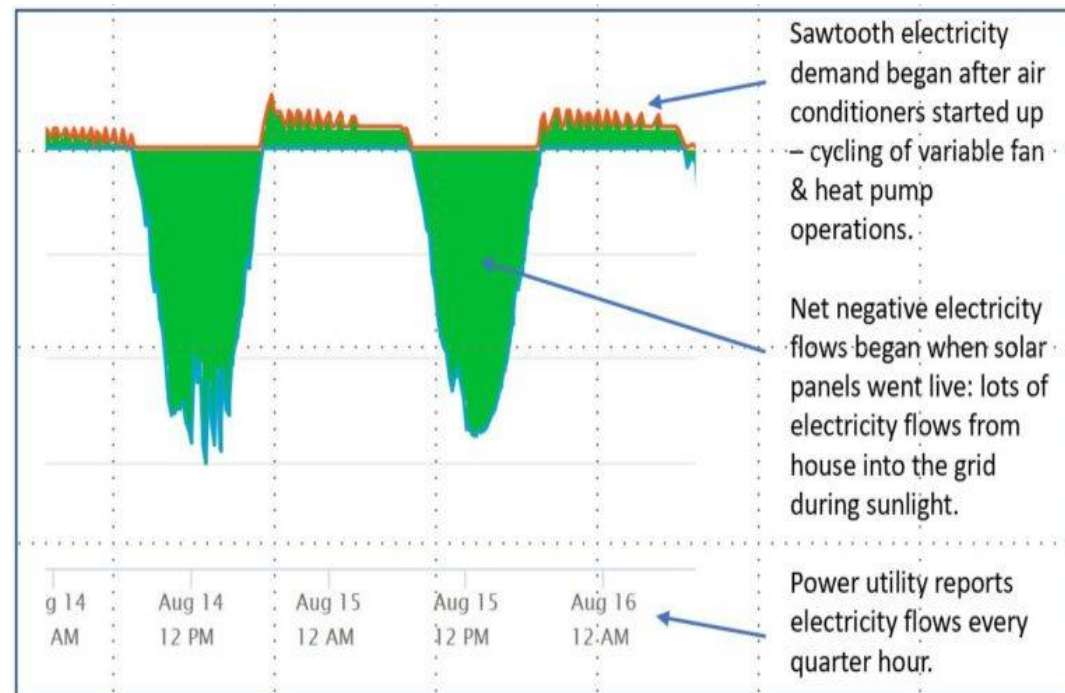


## 2 Teslas & 3 Powerwalls



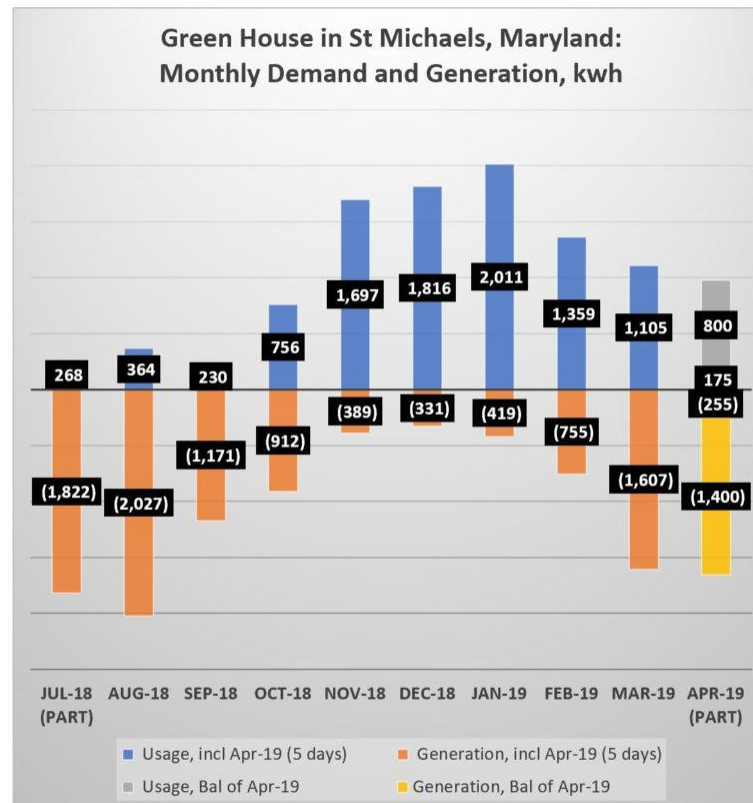
# Beyond ZNE

## Net load centers



Source: <http://bsaenergy.com/wordpress1/>

# Prosumer most of the time



Source: Choptank Electric Cooperative



# New electric company: Your home

Wall Street Journal 21 Jan 2015



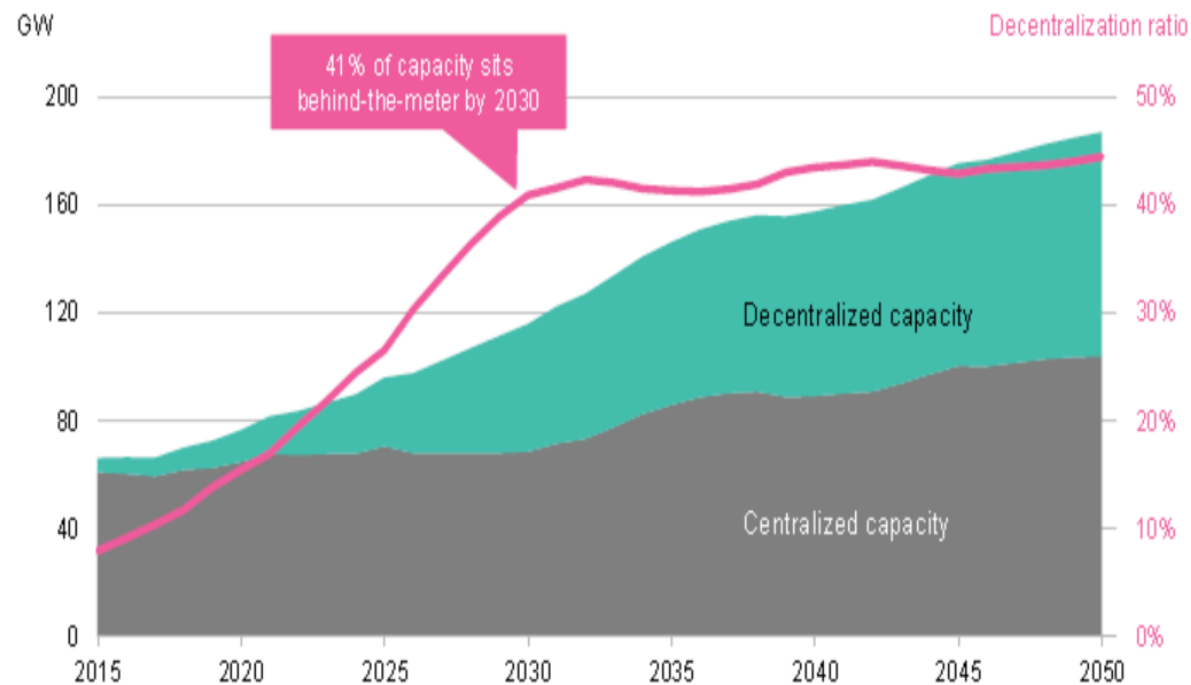


# Totally off grid “nonsumer”



Source: Off Grid Electric

# 2+ million Australian solar roofs



Source: Annabel Wilton, BNEF, presented at Australian Clean Energy Summit, Sydney, July 2018

# Mike Swanston may explain?

- ♦ Why 2 m in a country of 25 m?
- ♦ What is driving consumers to become prosumers?
- ♦ What does so many PVs do the network?
- ♦ What are the equity/subsidy implications?
  - Who is subsidizing whom?
- ♦ What about storage & EVs?
- ♦ What new business models?
- ♦ What is the reaction of suppliers?
- ♦ What is the role of regulators?

# It is already happening

Sales not same as consumption

- ♦ CEC's 2030 demand forecast for California, GWhs

	<u>2018</u>	<u>2030</u>
Consumption	260,000	340,000
Sales	260,000	290,000

# P2P trading?

Any solar roof can be an EV charging point





# Integrated?

Tesla energy: Generation, storage, consumption + mobility



Source: Tesla unveils residential solar roof and new Powerwall battery, Utility Dive, 28 Oct 2016

# Major trends ...

- ◆ Balance of power ...
  - ... shifting to **consumers**
- ◆ Future of electricity ...
  - ... is **behind-the-meter** as both mechanics & economics of consumption, generation & storage is radically altered
- ◆ Innovation ...
  - ... leads to **disruption** with emergence of intelligent aggregators & platforms allowing P2P trading, VPPs, etc.
- ◆ ... using an outdated T&D infrastructure

# Today's agenda

- ♦ Mountain BTM prospects: do prices matter?
- ♦ Cormack Title
- ♦ Swanston What's in it for customers?
- ♦ Shaw-Williams Potential & perils of HEMS
- ♦ Kuiper BTM Governance
- ♦ Ryan Digital platforms to enable BTM service
- ♦ Mouchaileh Consumers exchanging value with the grid
- ♦ Rai & Chai SAPS
- ♦ Jamason Consumer choice & DG control
- ♦ Nelson & Sioshansi Wrap up